

Meeting Date: 26 October 2023

SYSTEM OPERATOR PERFORMANCE:
1 JULY 2022 – 30 JUNE 2023

SECURITY
AND
RELIABILITY
COUNCIL

This paper provides the SRC with a copy of the system operator's annual self-review, indicates the possible content of the Electricity Authority's corresponding review, and requests the SRC's advice.

Note: This paper has been prepared for the purpose of the Security and Reliability Council. Content should not be interpreted as representing the views or policy of the Electricity Authority.

1 Background to annual reviews of the system operator's performance

- 1.1.1 The Security and Reliability Council's (SRC) functions under the Electricity Industry Act 2010 include providing advice to the Electricity Authority (Authority) on:
 - a) the performance of the electricity system and the system operator
 - b) reliability of supply issues.
- 1.1.2 The SRC was given a specific mandate for system operator performance because of the information asymmetry that arises between the Authority and the system operator. As a group with industry and consumer representation, the SRC can bring perspectives to the system operator's performance otherwise unavailable to the Authority.
- 1.1.3 The Electricity Industry Participation Code 2010 (Code) requires the Authority to review the system operator's performance each year. In doing so, it must take account of a self-review that the system operator must perform each year under the Code.¹
- 1.1.4 The system operator has completed its self-review of its performance for the 2022/23 financial year, and the Authority is currently drafting its corresponding review.
- 1.1.5 The purpose of this paper is to request the SRC advice to the Authority regarding the system operator's performance in the 2022/23 year. To inform that advice:
 - a) attached to this paper is a copy of the system operator's annual self-review (Appendix A)
 - b) this paper gives an indication of the preliminary Authority management review (Appendix B).

2 Context – previous SRC advice

- 2.1.1 To provide context to this year's review, the SRC's comments to the Authority regarding the system operator's self-review for the immediately prior 2021/22 financial year included (in summary) that:
 - a) Members appreciated the focus on ensuring the report is concise and readable. The inclusion of further opportunities sections was seen as a useful addition. Information about lessons learnt is not separated out, and from the SRC's perspective reinstatement of lessons learnt would be a welcome addition in future reports. This would demonstrate an understanding of the difference between the feedback received (lessons learnt) and supporting continuous improvement (opportunities).
 - b) The system operator's engagement with industry was being positively received and the SRC acknowledged the system operator scored well in its annual survey. It was pleasing to hear the system operator will include transactional

¹ Clause 7.11 of the Code specifies the requirements of both the system operator and the Authority in reviewing the system operator's performance.

feedback in future self-review cycles. The SRC recommended the Authority include these commitments in the current review of performance metrics to apply from July 2023, as a further opportunity to increase trust and confidence in the system operator and sector generally.

- c) The low distributor response to the annual survey was of concern, which highlighted the need for the system operator to prioritise engagement with distributors to ensure a system-wide approach to security and ensure focus is on the right risks at the right time.
- d) The SRC appreciated the system operator's acknowledgement of its shortcomings as the cause of the 9 August 2021 event. However, the SRC was concerned the system operator is still including generation shortfall as the cause of this event and subsequent events. The SRC considered it was unnecessary to add this statement when system operator modelling, and communications were the primary contributors to the event. The SRC believed reference to the '9 August event' without additional qualification or cause is all that was required in the report.

3 Points to note

- 3.1.1 Authority staff have provided a draft initial commentary on the system operator's self-review (included as Appendix B).
- 3.1.2 Staff consider the system operator has responded well to system events during the review period, in particular with Cyclone Gabrielle.
- 3.1.3 In line with previous SRC advice, there are sections on opportunities to improve and lessons learned. The SRC may like to consider whether these meet expectations and if not, what further content would be appropriate.

4 SRC feedback

- 4.1.1 The Authority appreciates feedback from SRC members on any aspects of system operator performance that they may wish to comment on, even if it is not included in either the system operator's self-review, or the Authority's review. The SRC's advice to the Authority on this matter is valuable, as evidenced by SRC advice over the years typically being adopted as recommendations into the Authority's annual reviews.
- 4.1.2 An indication of the content of the Authority's review is included in Appendix B. It provides an indication of the initial assessment of the system operator's performance and what recommendations the Authority is considering making to the system operator as opportunities for improvement. This is a first draft and will be subject to amendment as it goes through the Authority's internal review process, including incorporating feedback from the system operator and the Authority's Board, as well as the SRC.

4.2 Questions for the SRC to consider

- 4.2.1 The SRC may wish to consider the following questions.

Q1 What aspects, if any, does the SRC wish to highlight of the system operator's performance as strengths or having markedly improved?

- Q2** What concerns, if any, does the SRC have about the performance of the system operator?
- Q3** What aspects, if any, of the system operator's functions would the SRC like the system operator to give greater weight to in its dealings with stakeholders?
- Q4** What further information, if any, does the SRC wish to have provided to it by the secretariat?
- Q5** What advice, if any, does the SRC wish to provide to the Authority?

5 Attachments

5.1.1 The following items are included as attachments to this paper:

- a) System operator annual self-review and assessment: 1 July 2022 – 30 June 2023 (Appendix A)
- b) Indication of preliminary content of Authority's annual review of system operator performance, for the period 1 July 2022 – 30 June 2023 (Appendix B).

Appendix A System operator annual self-review and assessment: 1 July 2022 – 30 June 2023

Appendix B Authority staff draft initial comments on the annual review of system operator performance 2022/23

1. Transpower, in its role as the electricity system operator, is responsible for the secure, efficient operation of the power system in real time. The system operator's role is broad, complex, and critically important to New Zealand.
2. In our role as industry regulator, the Electricity Authority Te Mana Hiko (Authority) is responsible for defining the role of the system operator and assessing the system operator's performance. We require the system operator to carry out its obligations with skill, diligence, prudence, foresight, good economic management and in accordance with recognised international practice.
3. Overall, we are satisfied with the system operator's day-to-day business. The system operator operated well during several events throughout the year, the most notable being Cyclone Gabrielle.
4. During the period from 1 July 2022 until 30 June 2023, we were satisfied with the system operator's:
 - ✓ Collaboration and engagement with us on the refresh of the system operator's performance metrics
 - ✓ Industry exercise (day 1) in May 2023, which was successful, professional, and collaborative.
 - ✓ Collaboration, expertise, and engagement with the Authority on day 2 of the industry exercise (which was run by the Authority).
 - ✓ Collaboration and flexibility on designing and implementing the winter 2023 initiatives.
 - ✓ Communication and development with the Authority and other stakeholders on the Future Security and Resilience programme.
 - ✓ Long term collaboration, coordination, and professionalism on implementing the real-time pricing changes. The smooth go-live of phase 3 and 4 with no adverse impacts on market operations was credit to the implementation teams.
 - ✓ Continued communication with stakeholders on a fortnightly basis with a focus on operations
5. The system operator has acted on the recommendations made in the 2021-22 financial year, in particular:
 - a. Continuing to engage with participants from all sectors of the industry. This was particularly important during the severe weather events during the year, with the system operator communicating with participants over several different mediums. We look forward to the system operator looking for further opportunities to improve its communication and engagement.
 - b. Reinstating the lessons learned section of the self-review, with a summary of the lessons learned in an appendix for easy reference.
6. The Authority has three recommendations for the financial year 2023-24:
 - a. In collaboration with the Authority, the system operator considers running a simulation for its next industry exercise in 2024, with more interactive elements for a

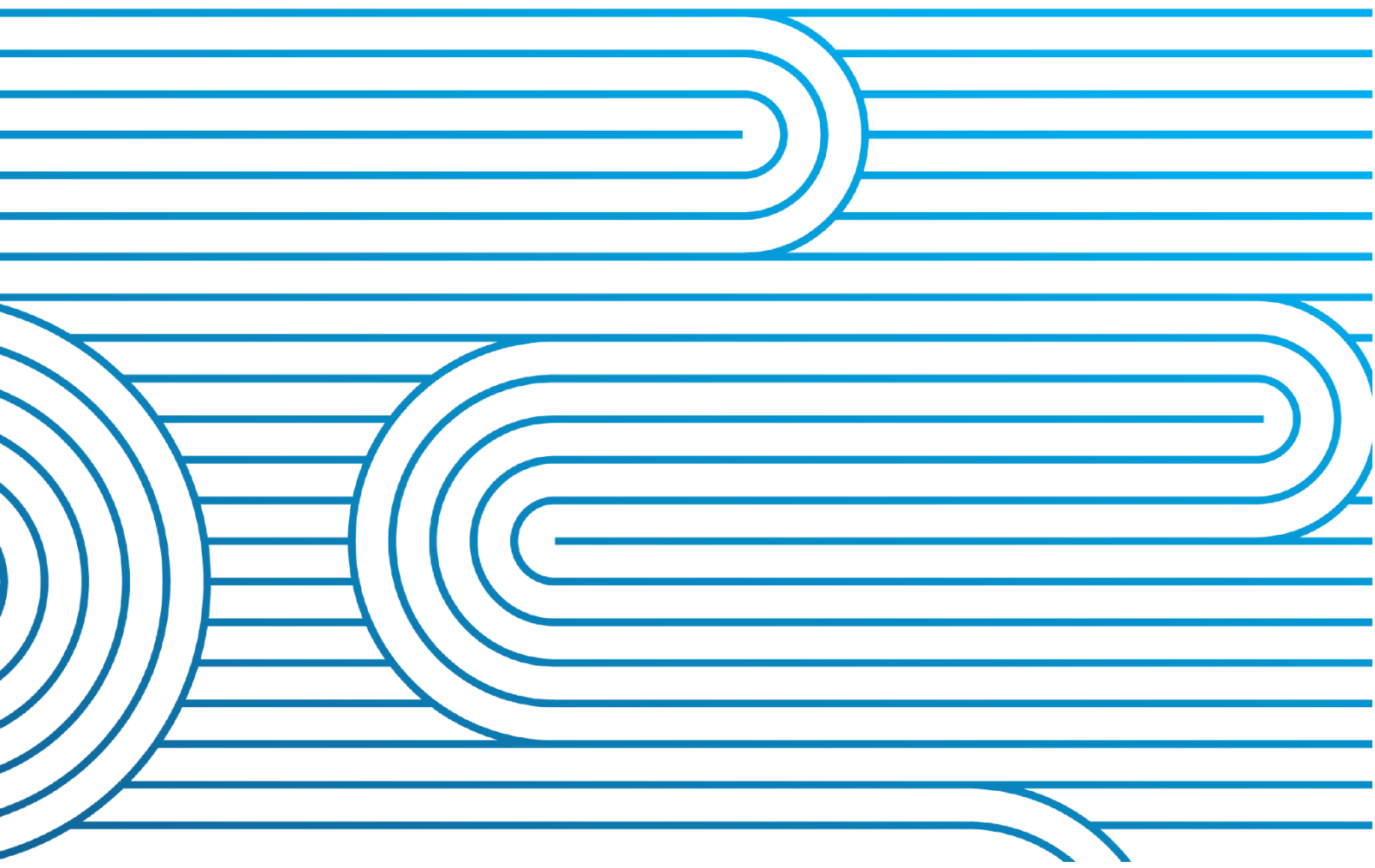
wider range of participants (ie including direct connects) and with elements of surprise. We consider including these elements in an industry exercise would ensure the industry continued to be engaged in the exercise and assist with preparedness for unexpected events. We also recommend that the system operator starts preparation for the 2024 exercise early to ensure that the exercise meets its objectives and is well planned and executed.

- b. We recommend that when the system operator is performing a business assurance audit, the system operator includes an audit of software used in the process (including the inputs, outputs are as expected, and software is functioning as in the functional specification), especially software that is infrequently used, and regularly reviews its manual data update processes for market system tools and their fitness for purpose as part of the business assurance audit. This supports the finding from the recent business assurance audit for the Voltage Stability Assessment Tool (VSAT), where it is acknowledged that manual errors can impact on real time operations.
- c. We recommend that the system operator includes a section in the self-review that acknowledges any issues, events, or near-events that occurred or concluded in the year, for example Rulings Panel decisions. We also recommend that the self-review better reflects on the things that did not go well and what the system operator learned from this.

System Operator annual self-review and assessment

2022-23

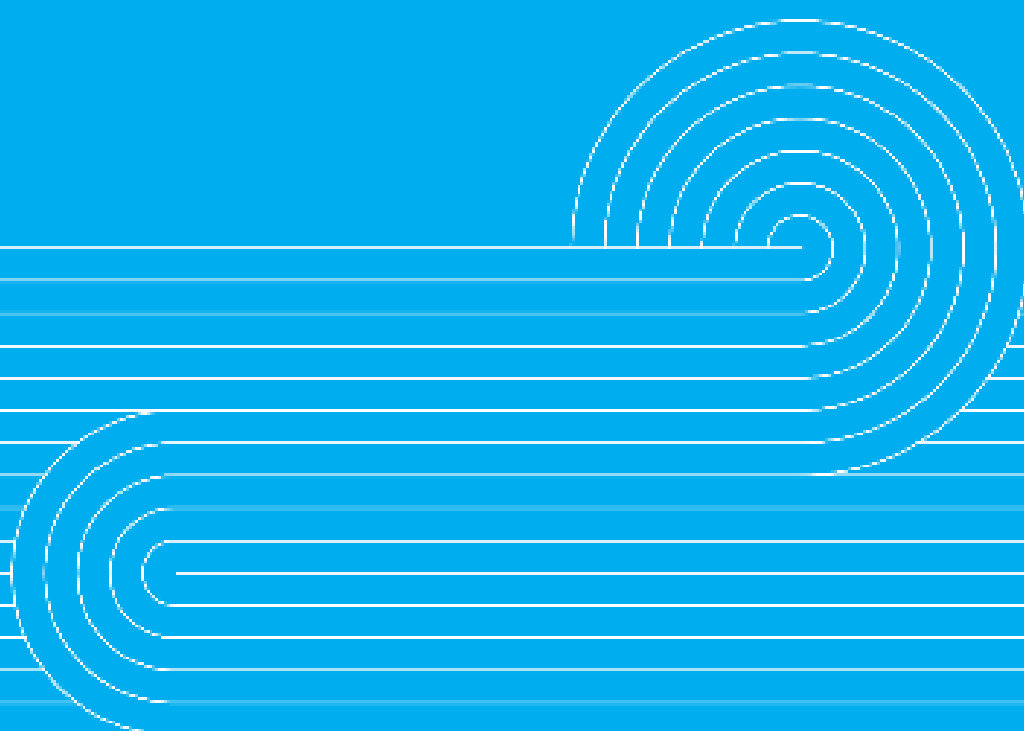
Date: August 2023



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1 About this document



1.1 Purpose

This is our self-review and performance assessment for the period 1 July 2022 – 30 June 2023, as required in the Electricity Industry Participation Code 2010 (Code)¹ and the System Operator Service Provider Agreement (SOSPA)².

1.2 Structure of the report

The role of the System Operator is complex, sitting at the centre of real time power system and market operations. Our role is broad and involves strategic planning far ahead of the day-to-day activities. This report covers deliverables under two different timeframes:

- long-term planning
- short to medium-term activities.

Other, non-time-defined deliverables are in a separate section.

Each section of the report outlines our role, a brief description of the tasks/activities undertaken this year (including items we identified as a further opportunity last year), and further opportunities that we have identified as potential continuous improvement for future years.



We have highlighted areas where we have identified opportunities to learn and improve throughout this review.

Note that the details of our activities to successfully carry out the 2022-23 stakeholder education and engagement plan are included in Appendix 1: Delivery against the Education and Engagement Plan for 2022-23.

¹ Electricity Industry Participation Code 2010, section 7, clause 7.11

² SOSPA, clause 12.4

2 Overview



2.1 Overview of the year

This has been both a challenging and exciting year for the system operator and wider industry. The rapid increase in connections shows that we are now firmly in the transition to a highly renewable system, the completion of real time pricing has fundamentally shifted how the market operates, and new technologies and business models are being implemented to meet system challenges.

These changes have significant impact on the way in which we maintain a stable, reliable power system and highlight the need for a combined industry approach. This is why we have continued to step up our engagement with the industry and regulator, in particular to address the challenges of thermal commitment combined with demand growth and introduction of new technologies. This whole system leadership and discussion is paramount to tackling the longer-term risks and challenges we face.

To highlight the different aspects of work we have been involved in to provide focus on the winter peaking challenge, we've included a case study.

A further focus this year has been to test and update operational procedures, particularly those for managing potential generation shortfall events. We have been closely monitoring our performance with a set of metrics for events incorporated into our performance metrics this year.

There are many achievements my team and I have been proud to deliver this year, including:

- The milestone achievement dispatching the market on real time pricing, which also included the functionality to enable active demand side participation.
- A complete revision of the performance metrics, targets, and the incentive payment calculation for 2023-24 which modelled our collaborative ways of working with the Authority.
- A refresh of our strategic framework and planning process to reflect accelerating industry change.
- A major update of the System Security Forecast (SSF) which concluded that we are confident we will be able to meet our PPOs as set out in the Code over the next three years, given the currently available information.
- Our support of Ara Ake and solarZero in a trial to support the integration of an increasingly diverse mix of technologies into the generation/demand offerings into the market.
- An industry exercise in late May, taking local EDBs through low residual generation situations and grid emergencies, and providing the opportunity for the industry to share their knowledge and experience.

In February, we carried out a live exercise of our business planning capability following the weather events of Cyclone Gabrielle, resulting in the loss of electricity supply to Hawke's Bay and Tairāwhiti. We worked efficiently and effectively with the grid owner and local EDBs to restore energy to the region using our coordinated incident management system roles to our internal roles and provide context to support our response.

We are pleased to receive positive feedback from our stakeholders in our annual survey, 83% of which agreed or strongly agreed that we were delivering well to our system operator contract. We also appreciated feedback to let us know areas where we still have room to improve, and we have taken this onboard as part of our commitment to continuous improvement.

Our commitment to enhancing the long term-benefit to consumers and the wider industry continues via our forward thinking workstreams, notably with our contribution to the Authority's Future Security and Resilience (FSR) programme and considering the role of the future system operator.

As we progress into 2023-24, we look forward to continuing to support and partner with the Authority and the wider market, ensuring a secure and reliable power system throughout the transition to a highly renewable future.

Dr Stephen Jay
GM Operations

CASE STUDY: Winter peaking challenge

Traditionally New Zealand's security of supply challenges have been driven by dry winters when there is a shortage of fuel. Recently the challenge has extended to meeting increasing winter demand peaks at times where high levels of hydro storage and growing renewable generation on the system have made slow start thermal generation less economical (or at times physically incapable) to cover tight margins at short notice.

Periods of tight margins during peak demand have become more frequent. Since the beginning of 2023 up until the end of June, there have been 11 occasions where low residual Customer Advice Notices (CANs)³ were issued (compared to 11 Low Residual CANs (LRCs) for winter 2022). Of this year's LRCs, there have been eight periods where the residual has dropped below 200 MW in real time, however, there have been no energy shortfalls, although on one occasion we did get within 50 MW of needing to declare a grid emergency⁴. It should be noted demand has yet to reach peak expected levels as temperatures have been relatively mild compared to a typical winter.

The system operator's role in meeting peak demand is:

- Informing the market of the level of available capacity across different time frames.
- Coordinating the market to ensure capacity is made available where possible.
- Taking emergency actions to reduce demand should there be insufficient supply to meet demand.

Through the reporting period, we have targeted the peak capacity challenge across a range of our activities to ensure that we have done everything in our power to ensure the lights stay on for New Zealand through winter peak periods:

³ A low residual CAN is generally issued when residual generation is expected to be 200 MW or less for future trading periods in the operational horizon.

⁴ Examples of when a grid emergency is declared are when the ability of the system operator to comply with the principal performance obligations is at risk or compromised, public safety is at risk, there is a risk of significant damage to assets or an unsupplied demand situation.

1. Informing the market

We shared analysis in a series of market insight papers published on our website:

- [System Operator Winter Review paper](#) (Nov 2022). Analysis of the winter peak capacity challenges experienced in 2021 and 2022 and explored the potential size and shape of the peak capacity challenge in 2023.
- [Winter peak analysis: 2024 and 2025](#) (Apr 2023). Analysis of the winter peak challenge over a 3-year horizon, including a high probability of winter peak capacity shortfalls without sufficient firm generation and/or demand response available.

We have also been working closely with the Electricity Authority (Authority) to test the feasibility of a range of options which may in part mitigate winter capacity risks. These initiatives were only feasible in the short timeframes due to trials and thinking undertaken in advance by the system operator. The initiatives were:

- Provide better information on headroom in supply stack.
- Provide forecast spot prices under demand sensitivity cases.
- Review of wind offers based on external forecast.
- Clarify availability of 'discretionary demand' control (such as ripple control).

More details on winter 2023 initiatives are included in section 4.1 of this report.

Our annual Security of Supply Assessment (SOSA) for 2023 is the first annual assessment to look at the winter peak capacity issue faced by the industry and showed this issue is likely to persist for the rest of the ten-year assessment horizon. The assessment makes it clear that urgent investment is needed in flexible resources that can contribute to meeting peak demand.

2. Coordinating the market

We held an extended industry forum at the end of May to reinforce our approach for managing a potentially tight winter, entitled "Navigating the winter capacity challenge". It identified the issues that the industry needs to be aware of and could contribute to providing a degree of resolution. We also held an industry exercise in May with market participants and distribution companies to ensure that processes and procedures were understood.

3. Taking (or preparing for) emergency action

We included an additional sensitivity to our SOSA, "Less Flexible Operational Capacity", which explores the market co-ordination challenge of integrating increased intermittent generation with slower start thermal plant. While the SOSA does not provide a nuanced analysis of this issue, this sensitivity gives an indication of how this situation can impact the North Island winter capacity margin.

More details on the SOSA are included in section 3.4 of this report.

The actions this year have been useful additions to inform the industry of periods of tight margins, but it is worth stressing the need for further work to manage future years since none of the above provide certainty.

2.2 Response to the Authority's 2021-22 recommendations

In its review of the system operator performance for 2021-22, the Authority made four recommendations which we have acted upon:



Recommendation 1:

The Authority recommends a joint review of the process of engagement between the Authority and system operator on large capex projects spanning multiple years, including the integrated product life cycle (IPLC) process.

The system operator ran a workshop for Authority staff in June to discuss the TAS mechanism and other project delivery frameworks. This informed the scope of the 2023-24 Statutory Objective Work Plan around how best to address this recommendation collaboratively with the Authority.



Recommendation 2:

The Authority acknowledges it can be challenging to engage with all sectors of the industry and encourages the system operator to continue to undertake engagement with participants. Continued engagement will ensure a system-wide approach to security and focus is on the right risks at the right time.

Section 5.3 of this report sets out the highlights of our industry engagement in the 2022-23 year. It is an area we are committed to and is essential as the industry works together to face the changing environment. In recognition of this importance, a number of the new performance metrics have been targeted to monitor our success in this area.



Recommendation 3:

The 'further opportunities' sections in the system operator's self-review are a welcome addition but highlight that the system operator will continue to operate as it has in the past, with small changes. In these sections, the Authority recommends the system operator show further leadership about how the system operator will respond to the uncertainty that is coming.

Our work with the Authority such as the Future Security and Resilience (FSR) programme, the roll-out of the RTP project and our delivery of the winter 2023 initiatives (under TAS 104 and 105) illustrate that we take the role of leadership seriously. We also published thought pieces on future challenges (e.g. distributed energy resources, inverter-based technology considerations) to inform industry and have proactively engaged with industry groups tackling these challenges at both delivery and leadership levels. Our refreshed strategic plan and upcoming work with the Authority on the SOSPA3 period will address more significant future changes.

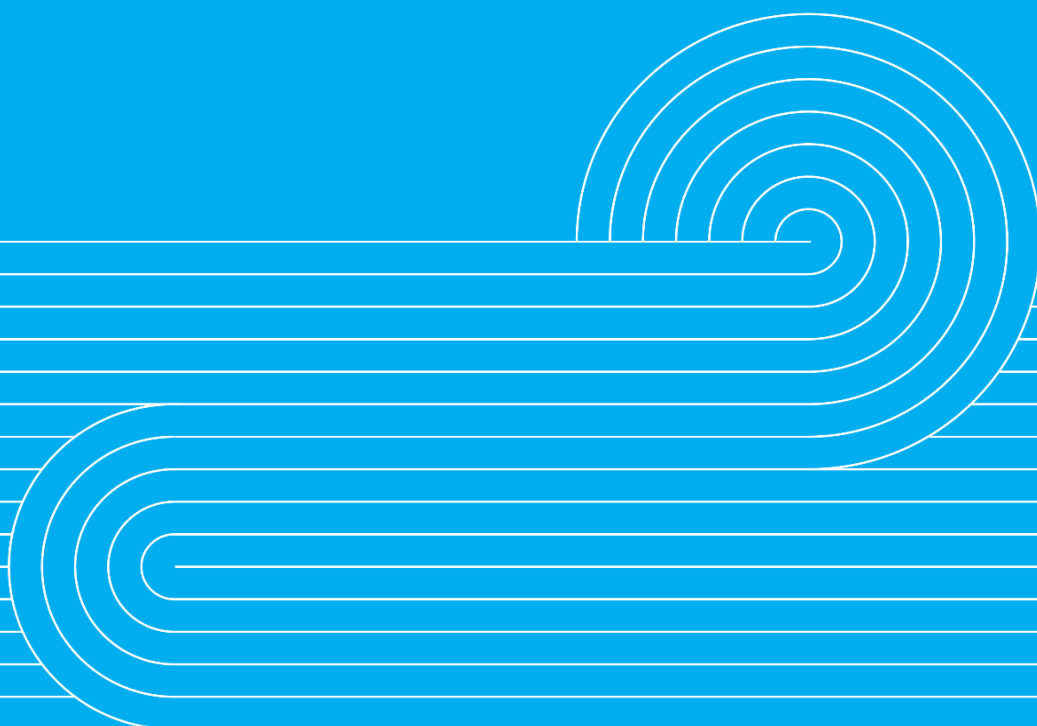


Recommendation 4:

The Authority recommends the 'lessons learned' sections from previous reviews is re-instated alongside the newly added further opportunities sections. In previous reviews including a separate lessons learned section demonstrated an understanding of the difference between feedback received (lessons learned) and supporting continuous improvement (opportunities).

The 'lessons learned' sections have been re-instated in this year's report. 'Lessons learned' in this report relate to feedback and observations specific to our delivery during the reporting period, while opportunities identify where further effort and investment could deliver consumer value in the future. A summary of the 'lessons learned' is contained in Appendix 2.

3 Delivery: strategic and long-term activity



3.1 Statutory objective workplan

The statutory objective work plan (SOWP) is a requirement outlined in the SOSPA⁵. The intent of the plan is for the system operator to provide its service in a manner which assists the Authority to give effect to its statutory objective.

The 2022-23 SOWP contained one objective – to complete the **revision of the performance metrics, targets, and the incentive payment calculation**, ready for implementation in 2023-24.

We successfully delivered a full refresh of the system operator metrics and incentive mechanism. The process was highly collaborative, working with the Authority via a series of workshops and regular meetings to ensure the new metrics meet the needs of both parties.

The joint development process adopted for this project has received positive feedback from both the Transpower and Authority senior management and governance roles.



Working collaboratively means both parties are engaged in the performance framework and invested in the need to continually maintain and the monitor it into the future.

The collaborative approach has built positive relationships and good practice which could be deployed across other regulatory and organisational change involving both organisations.

Further opportunity

The quarterly review process for the new metrics framework will provide opportunities for continuous improvement of the metrics and incentives framework.

3.2 Development of the electricity system and market

We have continued our work with the Authority and industry to progress the Future Security and Resilience (FSR) programme. We informed the roadmap published as part of the FSR programme which sets out an 8–10-year programme of work and since then supported the Authority in a number of activities, including development of:

- a set of FSR indicators based on our previous work. These are used to help ensure the timing of addressing FSR challenges and opportunities is tracking acceptably.
- an issues paper on power system common quality, including undertaking analysis to provide technical case studies in the paper.

"Transpower do a good job of keeping up with an ever-changing environment"

Market Participant

⁵ SOSPA, clause 5.5

We are one of 11 representatives who are appointed to represent a broad array of expertise in the electricity industry on the Common Quality Technical Group (CQTG), providing independent advice to the Electricity Authority on common quality requirements during the review of Part 8 of the Code.

We supported the Authority in its review of numerous submissions to their common quality issues paper and helped to develop an initial long list of options to resolve these issues along with option evaluation criteria. Alongside the Authority, we facilitated a workshop to develop a plan to progress the work from an issues paper through to Code changes. This forms the scope of the TAS project for the 2023-24 financial year.

As part of the RTP project, we opened up active participation for the demand side with the introduction of the dispatchable demand and dispatch notification enhancements. Participants are now able to bid and offer their demand flexibility and distributed energy resources into the wholesale market with more certainty.

This year, as part of our thought leadership publications, we produced a future thinking paper on “Preparing for an increase in inverter-based resources”. The aim of this paper was to bring to the attention of the industry some preliminary investigations we have undertaken to determine what is necessary to prepare for an increase in inverter-based resources.



From our investigation into load modelling techniques, and comparing what we do today versus what other system operators are doing, we have learned that although we are managing the change well, other countries are looking at how to do it better and we need to keep pace.

The initial project management approach for TAS 102, with the Authority driving the work and the system operator providing SME input as required, did not work as successfully as other TAS projects. For future projects we will discuss how the project and programme management can be optimised.

Further opportunity

In light of the amount of generation expressing an interest in connecting to the grid, we will perform an end-to-end commissioning process review.

Following our implementation of the Transient Rotor Angle Stability (TRAS) project, we will start to look at a small-system stability analysis tool (SSAT) and investigate the known importance of electromagnetic transients (EMT) modelling going forward. This investment in new tools and technologies shows our commitment to strengthen our capability in this area.

3.3 Strategic and business planning

A clear and coherent strategy is essential in the increasingly complex environment in which energy systems are transitioning to a renewable future.

The strategic plan for the system operator is delivered as part of the SOSPA⁶ agreement. A business plan for the delivery of this long-term strategy over the next financial year is also provided as part of SOSPA⁷.

⁶ SOSPA, clause 16.2

⁷ SOSPA, clause 16.4

These deliverables reflect the actions required of a prudent system operator and means by which we are accountable for, and measure, the phased strategic thinking.

As part of the strategic and business planning, we identify the necessary changes required to develop the system operator software during at least the next five financial years which inform the plans for capex projects and capex programmes.

This year we refreshed our strategic framework and methodology, in addition to refreshing the thinking in our strategic plan. The new framework and methodology build on Authority feedback from the previous year, providing a clear link to both the Authority's strategic direction and that of Transpower. It also links enhanced horizon scanning through to the direct impacts on the system operator service, and the strategic focus areas which will ensure that the system operator continues to deliver value to consumers in the future. These focus areas encompass the need to deploy new technology and ways of working, facilitate competitive markets, and support stakeholders in their own innovation – in order to deliver the most benefit to electricity consumers.

The strategic plan also includes further opportunities that we will discuss further with the Authority, some of which sit outside of our current funding level and role.



We have received positive feedback on both the quality of content of the strategic plan and the collaborative and engaging process used for its development. Testing both the methodology and the content with Authority staff and other stakeholders delivered both a better output and outcome.

Further opportunity

The strategic business planning this year will inform our renewal of SOSPA under SOSPA3 and the scope of the 2023-24 Statutory Objective Work Plan.

3.4 Security of supply – long-term

Each year we publish the Security of Supply Assessment (SOSA) which assesses the power system's ability to meet the Authority's security standards for winter energy and peak requirements over the next ten years. In November, we consulted on reference case assumptions and both supply side and demand side sensitivities from the reference case. The SOSA consultation was published in early May, and we published our final analysis in June. We received positive feedback on the inclusion of a new sensitivity which considers the impact of operational coordination and flexibility challenges on security margins.

We published two market insights papers on the challenges of winter capacity. The paper published in November analysed the winter peak capacity challenges experienced in 2021 and 2022 and explored the potential size and shape of the peak capacity challenge in 2023. The paper in April showed the high probability of winter peak capacity shortfalls in 2024 and 2025 without sufficient firm generation and/or demand response available.

An overview of the security of supply issues relating to winter capacity peaks is provided as a case study in the overview section of this report.



“Joining the dots” between deliverables and organisations - in this case, market insight papers, the new SOSA sensitivity, and the Authority’s winter consultation - enables coordinated cross-industry response to system challenges.

Further opportunity

We will investigate opportunities to enhance and evolve how New Zealand considers security of supply.

3.5 System security forecast

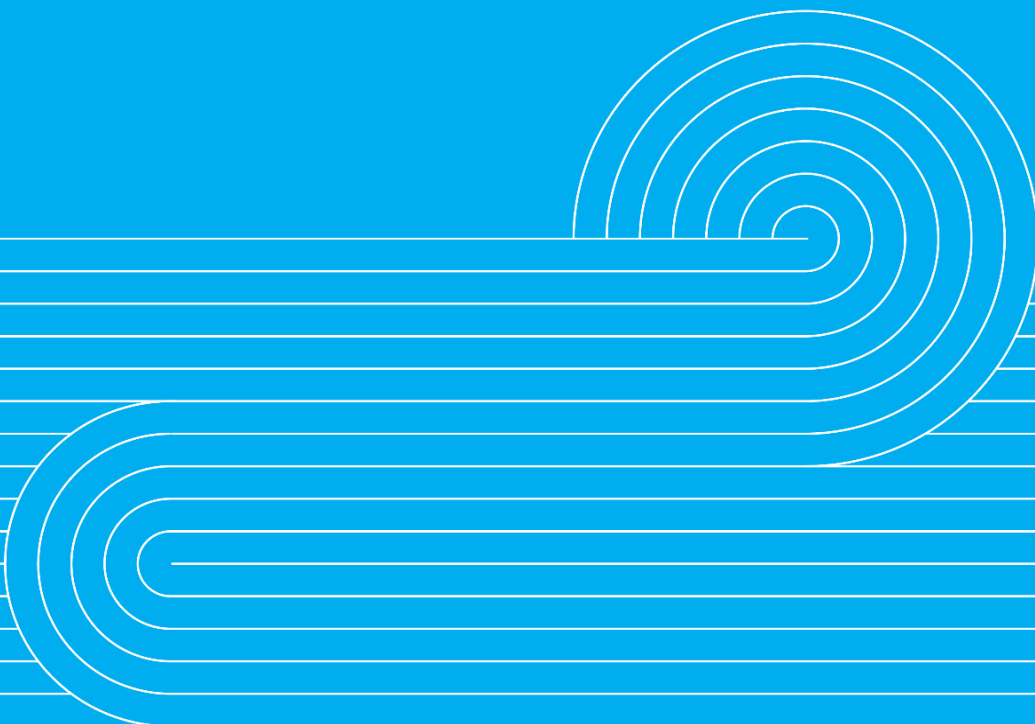
The System Security Forecast (SSF) is a forecast of the system operator’s ability to meet its principal performance obligations (PPOs) over the next three years. The SSF is produced every two years and revised every six months if required.

The latest SSF major update was delivered in December 2022. This update concluded that we are confident we will be able to meet our PPOs as set out in the Code over the next three years given committed asset changes, growth in demand and existing operational practises. Our six-monthly review was published in June 2023 with minor updates.

Further opportunity

We are considering how to evolve the SSF to consider the likely future operational challenges, such as transient rotor angular stability, as the proportion of inverter-based resources increases on the system.

4 Delivery: medium to short-term activities



4.1 Security of supply - medium to short-term

The system operator monitors and informs industry on security of supply issues related to both capacity (i.e. "winter peak") and energy (i.e. "dry year") risks. An overview of the security of supply issues relating to winter capacity peaks is provided as a case study in section 2 of this report.

Early in the reporting period, we identified opportunities to enhance our toolset around capacity risks, including solutions we had previously trialled to enable the industry to have greater visibility of the winter peak challenges. These informed two TAS projects which delivered the following winter 2023 initiatives and were only feasible in the short timeframes due to the trials and thinking undertaken in advance by the system operator. The initiatives were:

- Provide better information on headroom in supply stack.

Residuals calculated for forward schedules are available publicly on the Wholesale Information Trading System (WITS) enabling the market and stakeholders to monitor security margins.

- Provide forecast spot prices under demand sensitivity cases.

The market can now see how sensitive prices are to changes in load on WITS via sensitivity schedules. Sensitivity schedules present the potential market price outcomes for a change in load compared with the regular production market schedules.

- Review of wind offers based on external forecast.

The market can now see the range of uncertainty in wind generation on the em6 website. This consists of a third-party forecast of wind generation compared to aggregated wind generation offers from market participants.

- Clarify availability of 'discretionary demand' control (such as ripple control).

The quantity of load able to be controlled by Electricity Distribution Businesses (EDBs) during a grid emergency is now being offered into the wholesale market as difference bids when a Low Residual Customer Advisory Notice (CAN) is issued.

We have also established a system operator internal working group to maintain multi-disciplinary oversight of all risks anticipated this winter. While the primary focus is on national supply, a specific lens was applied to Hawke's Bay due to the impacts of Cyclone Gabrielle.

This year, we worked with the Authority to improve the quality of offers in the Weekly Dispatch Schedule (WDS) as slow start, less reliable thermal units are increasingly being used to firm intermittent generation. Further improvements and pilots to which provided the information to improve offers in the WDS and hence address the peak capacity risk were:

- Implementing additional data feeds and expert advice into our forecasting processes. These are in addition to the previous years' improvements, which resulted in a 30-50% forecasting improvement.
- Seeking expert advice via a daily MetService meteorologist consultation during winter to provide enhanced risk assessment of weather forecast uncertainty.
- Incorporating forecast uncertainty into the control room assessment of residual and subsequent notices, and load forecast adjustments. These now factor in wind uncertainty provided by an international intermittent generation forecaster, as well as the MetService daily briefing combined with insights from the load forecast.

- Updating the New Zealand Generation Balance (NZGB) scenarios to reflect low levels of baseload commitment.
- Setting up a key stakeholder distribution list to keep non-operational stakeholders – particularly in government and regulators – informed if an event should happen.
- Supporting Ara Ake and solarZero in a trial to support the integration of an increasingly diverse mix of technologies into the generation/demand offerings into the market.
- Updating the security of supply forecasting and information policy (SOSFIP) to reflect the commercial risk of gas reallocation and to simplify the modelling.
- Running an industry desktop exercise with select EDBs to test our rolling outage policy and processes. This has resulted in the system operator reviewing the system operator rolling outage plan (SOROP).
- Automating elements of the process to produce the Electricity Risk Curve process.

"We found Transpower to be interested in enabling new technologies into the power system "

Market Participant

As a result, the market appears to be responding more consistently to signals, without the need for an industry conference. We also now have visibility to controllable load which although it does not increase the pool of resources available, it does mean the load can be used more efficiently during an event. The outcome is that we are able to get more value from the pool of resources available.



The ability to trial small-scale pilots has enabled us to improve our knowledge in these areas of work and contribute to a fast turnaround of adoption when needed, such as the sensitivity schedules pilot and the wind forecast comparison.

Residuals have proved a good way of communicating security margins to the industry.

Further opportunity

Evaluate the performance of the combination of the existing and new forecast vendors in preparation for finalising the load forecast inputs into winter 2024.

4.2 System events

The system operator manages the electricity system to meet its PPOs. We record and review system events and report to the Authority on any moderate or major events using a definition agreed with the Authority. We manage (often potential) system events as part of our core role and events are logged and reviewed on a daily basis.

We have taken onboard the feedback from the 9 August 2021 event and progressed a number of initiatives to improve.

Our operating environment continues to be increasingly challenging due to tightening capacity margins, increasing quantities of variable generation and less flexibility available. Our work specifically targeted for winter 2023 shows this commitment and is highlighted as a case study in section 2 of this report.

"Major Changes from the past year, people trained up to required standards"

Market Participant

This section shares detail on a few of the more significant events through the 2022-23 year.

- 17 August: a fault of the grid owner's HVDC Pole 2 converter transformer neutral earthing resistor at Benmore required the system operator to take action to reclassify an HVDC bi-pole tripping as a contingent event in the market system between 03:30 to 11:30.
- 7 October events: We worked closely and well with the industry to minimise the effects of the HVDC filter outage, under-frequency event and grid emergency situation. We presented the timeline of the events of the week 3-7 October from a system operator perspective at our fortnightly industry forum with participants on Tuesday 11 October.
- 13 October 2022: A significant incident occurred when there was a loss of supply at Tauranga due to bird activity. Less than 70 MWh were lost over a 204-minute period, resulting in a 'moderate' classification. The investigation was completed in December 2022, with a final report delivered to the Authority in January 2023. No breaches or underperformance of the system operator service were identified.
- 22 November: In the early evening, a CAN was sent to advise that the system operator was managing for a potential island of the Hawke's Bay Region. There was then a triple circuit contingency of Fernhill-Tuai 1 and both the Redcliffe-Tuai 1 and 2 circuits. This rare event was caused by two simultaneous lightning strikes. A Tuai island of 40 MW briefly held before Waikaremoana generation tripped due to instability. Circuits to Tuai were restored using grid emergency provisions. This was discussed from a system operator perspective at our fortnightly industry forum with participants on Tuesday 29 November.
- February and March - Low Hydro Southland: Low hydro inflows in the Southland region had the potential, if the situation had worsened, to lead to security issues in managing voltage stability. We established a system operator working group to assess security risks and potential grid reconfigurations. A report outlining the potential issues and the reconfiguration options is published on our website.
- 14 February - Cyclone Gabrielle: We took proactive action ahead of the forecast cyclone, including identification of potential risks, and working with the grid owner to understand their risks. The impact of the cyclone required a considerable amount of system operator knowledge and commitment to ensure the grid returned to operation securely as quickly as possible. Flooding caused extensive damage at the Redcliffe substation in Hawke's Bay, resulting in the

loss of electricity supply to Hawke's Bay and Tairāwhiti. Our team used their experience and training to deliver electricity to the end consumers, working closely with distributors, generators and the grid owner. We produced two reports for this system event, an initial report and a more detailed report, which are published on our website.

- February: In order to manage the upper North Island voltage, we requested the grid owner extend Pakuranga-Whakamaru_1 circuit outage until 7 February. This approach managed the risks of switching cable circuits over the Auckland Anniversary and Waitangi weekends. Increased generation from Huntly and contributions from the newly commissioned Otahuhu reactor, are now in place enabling the grid owner to provide better voltage management should switching of cables be required.

We responded to these events by incorporating the lessons learned into our event preparedness. This preparedness includes collaborating with the industry and targeting specific training areas. The preparedness has also focussed on potential issues that may arise in winter 2023.

The preparedness work has involved:

- A two-part industry exercise (May)
- Part one was run by the system operator and focused on educating and working with EDBs to ensure we have alignment around the updated information being delivered by the Authority's winter 2023 initiatives work programme.
- Part two was led by the Authority and focussed on the communications from the system operator out to EDBs and retailers and on to end consumers. We supported the Authority with communications input and scenario examples.
- An extended SO Industry forum (May), entitled "Navigating the winter capacity challenge", to take all industry participants through our approach to winter, including how we will communicate any potential risk to consumers' electricity supply. 225 people attended this forum, up from around 75 who typically attend the fortnightly forums.



An independent review of the system operator's performance during the grid emergency on 23 June 2022 notes that the system operator's new demand management processes (implemented following the 9 August 2021 event) were successfully followed to manage the generation shortfall with minimal disruption to consumers.

Cyclone Gabrielle had significant impacts on the grid and managing the system securely through these challenges; this also had an impact on the market. One participant, as part of our annual survey, suggested we prioritised real time system security over market efficiency in one or more instances during this period. This is a reminder of the importance of how we communicate our decisions, PPOs, and overall role to stakeholders.

Early notification to the industry on potential events has been highlighted as valuable by participants in their survey responses as these enable them to react ahead of time.

Working closely with the industry to minimise the effects of system events has provided good two-way learning. The Authority considered the exercise to be "successful, professional, and collaborative".

Further opportunity

Review of winter 2023 to inform stakeholders and identify opportunities for improvement.

Share data on system performance at our fortnightly forums, to increase transparency of the system challenges we manage day-to-day (even when there is not an event).

Enhance governance, training, and change capability in our operational teams to ensure operational processes and resource planning responds to accelerating industry change .

Future industry exercises would benefit in involving the Authority earlier in the process to identify and address joint objectives. There is an opportunity to utilise the collaborative way of working from other activities for this in future.

4.3 Programme delivery

The Joint Development Programme (JDP), between the system operator and Authority, spans a period of five years and involves a range of projects related to service maintenance and service enhancement. The programme is updated at least annually and, as such, may change as planning assumptions become more certain over time.

We delivered the investigation and capital expenditure change projects outlined in the JDP and capital work programme, each of which is agreed with the Authority.

We successfully delivered four Technical Advisory Services projects for the Authority. Two of these have provided the initial framework required to move on to the next level of investigation, for which new TAS projects will be set up and carried out in 2023-24.

The system operator ran a workshop for Authority staff in June to discuss the TAS mechanism and other project delivery frameworks. Lessons learned from previous projects were shared.

We delivered above the 70% target of commissioned service maintenance projects on and under budget. We also exceeded our capital planning target which identifies a settled framework for programme delivery, as well as increasing assurance of scope and cost estimation.

The most significant change in the wholesale market since its inception, Real Time Pricing, was successfully released to production on 27 April 2023. As well as providing actionable prices in real time, it provides enhanced functionality for dispatchable demand and the new dispatch notified products.



The TAS workshop delivered for the Authority highlighted that the SOSPA contains a variety of mechanisms for the system operator to deliver different types of work for the Authority, but there is limited awareness and familiarity with these mechanisms among staff. This reinforced the value of training around the SOSPA as a tool to deliver market change.

Further opportunity

The discussion at the TAS workshop informed the scope of the 2023-24 SOWP around how best to address a previous Authority recommendation to review the integrated project life cycle (IPLC). Key to this review of the IPLC is the collaboration with the Authority, and there is an opportunity to explore how similar ways of working to those used to deliver the refresh of the performance metrics and incentives agreement could be used in this activity.

4.4 Performance metrics

The system operator performance metrics agreed with the Authority determine the system operator incentive payment⁸. This year they included three new event metrics to evaluate performance in preparing for, managing, and reviewing significant events.

The quarterly review sessions of the event metrics were a useful mechanism to keep the performance metrics front of mind.

Our final performance score for 2022-23 was 97% which leads to a \$200k payment from the Authority to Transpower.

The Performance Metrics and Incentives Agreement 2023-24 includes refreshed performance metrics developed as part of the SOWP 2022-23 and is discussed in section 3.1 of this report.



In addition to putting an important focus on how the system operator prepares for and manages system events, the design of the new event metrics provided a valuable “pilot” to learn from as we collaborated with the Authority to refresh the whole suite of performance metrics for 2023-24. Iterative and small-scale change of this sort can deliver results quickly and improve quality over time, based on real world testing.

Further opportunity

The new suite of metrics will be reviewed at the end of 2023-24. There will be opportunity to incorporate feedback, learnings from the system operator’s Operational Excellence programme, and progress from other internal performance metric development.

⁸ as set out in the System Operator Performance Metrics and Incentives Agreement

Performance metrics 2022-23

	Annual Target	Actual	Pass/Not Achieved	Incentive payment weighting
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We are smart about money

Perception of added value by participants	80%	83%	Pass	
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Our customers are informed and satisfied

Annual participant survey result		83%	89%	Pass	5
Annual participant survey result response rate	First tier stakeholders	80%	75%	Not Achieved	
Reports	Future thinking report	≥ 1	1	Pass	5
	Longer Market Insight reports	≥ 4	4	Pass	5
	Bite-sized Market Insights	≥ 45	49	Pass	
Quality of written reports		100% of agreed standard	100%	Pass	
Role impartiality		80%	90%	Pass	5
Responding to requests for information from the Authority		100% by agreed deadline	0 to date	N/A	

We maintain Code compliance and meet our SOSPA obligations

Market impact of breaches remain below threshold	≤ 3 @ ≥ \$40k	1	Pass	10
Breaches creating a security risk remain below threshold/within acceptable range	≤ 2	0	Pass	10
On-time SOSPA deliverables	100%	100%	Pass	10

We deliver projects successfully

Project delivery	Service Maintenance projects	≥ 70% achieved for approved time	82%	Pass	
		≥ 70% achieved for approved budget	73%	Pass	
	Market Design and Service Enhancement projects	≥ 70% achieved for approved time	100%	Pass	
		≥ 70% achieved for approved budget	100%	Pass	
Accurate capital planning		≥ 50%	55%	Pass	10

We are committed to optimal real time operation

Sustained infeasibility resolution	80% ≤ 10am business day 1 or as required	87%	Pass	5
High spring washer resolution	80% ≤ 10am business day 1 or as required	0 to date	N/A	

Our tools are fit for purpose

Capability functional fit assessment score	76.00%	69.10%	Not Achieved	
Technical quality assessment score	70.00%	71.60%	Pass	
Sustained SCADA availability	99.90%	99.99%	Pass	10
Maintained timeliness of schedule publication	99.00%	99.98%	Pass	10

We have the required skills for event management

Event preparedness	These are calculated via an agreed set of criteria with the Authority	10.4	12
Event management		11.0	13
Event review and improvements		12.0	12

Available points 122

Number of points achieved

= 118.4

Level of performance

= 118.4/122 = 97%

Related incentive payment

= \$200,000 paid by the Authority to Transpower as system operator

4.5 Business assurance audits and plans

Each year we agree with the Authority which business auditable services (BAS) will be audited during the financial year.

The five business assurance audits completed this year were:

- **Defects and Enhancements audit** (partially effective) with four high level findings relating to: establishing governance, prioritisation and remediation, reviewing incident information and following up overdue issues.
- **System operator load forecast audit** (effective) with four recommendations for management action identified, one medium and three low risk findings relating to: establishing an end-to-end process (medium), tidying up current process documentation (low), improving how we capture load forecast events (low), and updating the service provider contract to reflect current practice (low).
- **Voltage Stability Assessment Tool (VSAT) change management audit fieldwork** (partially effective) with two medium risk findings relating to: change management communication and collaboration, and manual processes and inputs.
- **Ancillary Service contract management audit** (effective) with two low risk findings relating to: process monitoring of test results, and event management framework.
- **Real time management of Simultaneous Feasibility Test (SFT) constraints** (highly effective) with one low risk finding relating to: the potential for subjectivity of when to enact the process.

The annual software audit of the system operator tools Scheduling, Pricing, and Dispatch (SPD) and Reserve Management Tool (RMT) found there to be no issues and was delivered on 31 March 2023.

The 2023-24 business audit plan has been mutually agreed between the Authority and the system operator and identifies the following five business assurance audits for next year:

- System Operator Gatekeeper Actions
- Discretion on demand/generation
- Management of Inputs to RMT
- Synchronise and Reconnect an Island
- Shortage of Supply Management.

Deloitte has completed the 2023 security of supply independence audit. It was a clean audit with no recommendations.

4.6 Outage coordination and assessment

The system operator assesses the impact of proposed outages on the operation of the system. This requires assessment of grid owner and customers' (EDBs, generators, direct connects) planned outages which are used to safely maintain equipment or fix problems to reduce the risk of 'unplanned' power outages. These assessments cover the period of months ahead of the outage to real time.

All outages require system operator assessment of the security impacts. In late October/early November there were over 180 transmission outages in one week.

This year there were several complex outage assessments required such as:

- Outages associated with grid changes such as the new Bombay interconnecting transformer.
- Outages to assist with managing high voltage over the summer months.
- System security risk assessments as a result of Cyclone Gabrielle, particularly the outages in Hawke's Bay.
- Assessment and reassessment of outages where we were seeing unusual system conditions such as low Southland generation, and low North Island thermal generation ahead of summer 2022-23.
- 2023 annual HVDC outage, a two-part outage (as resources from the February outage were redeployed to restoration work in Hawke's Bay during the original outage window). This required assessment of a second HVDC outage at the end of March.

Two of the existing operations planning applications were deployed into the operations customer portal this year, the planned outage coordination process (POCP) in July and the NZGB application in November.

The system operator provided input into the Transpower outage planning forum in March, and we completed our assessment of the security impacts of the resulting grid owner annual outage plan to enable it to be published in advance of the 19 May regulatory requirement.

Further opportunity

Use the SO industry forum to communicate complex outage conditions, particularly around unusual system conditions.

4.7 Commissioning new generation and demand response

We continue to enable customers to connect to the grid and enter the electricity market; generator commissioning activities are at the highest level in recent years.

We carry out a detailed commissioning process for each asset connecting to the grid to verify asset owners are able to comply with the asset owner performance obligations and technical codes at all times. This complex engineering verification process is essential to maintain the security of the grid and needs to be resourced appropriately to connect generation to meet New Zealand's renewable targets.

Via the Real Time Pricing (RTP) functionality, we have provided a platform for demand response products to be integrated into the wholesale market.

We supported solarZero to enable their aggregated battery systems to participate in the reserves market. Subsequently we supported Ara Ake and solarZero on a small-scale pilot to aggregate solarZero's household batteries into the wholesale electricity market as dispatch notified load. This was the first participant to take advantage of this new market product.



Learnings from the integration of new participants and new technologies such as solarZero's pilot include:

- there is a huge increase in workload when onboarding new participants who do not have a depth of technical and regulatory experience in the wholesale market and systems, and

this may increase as market participation increases in the future. Education and support for new participants is essential.

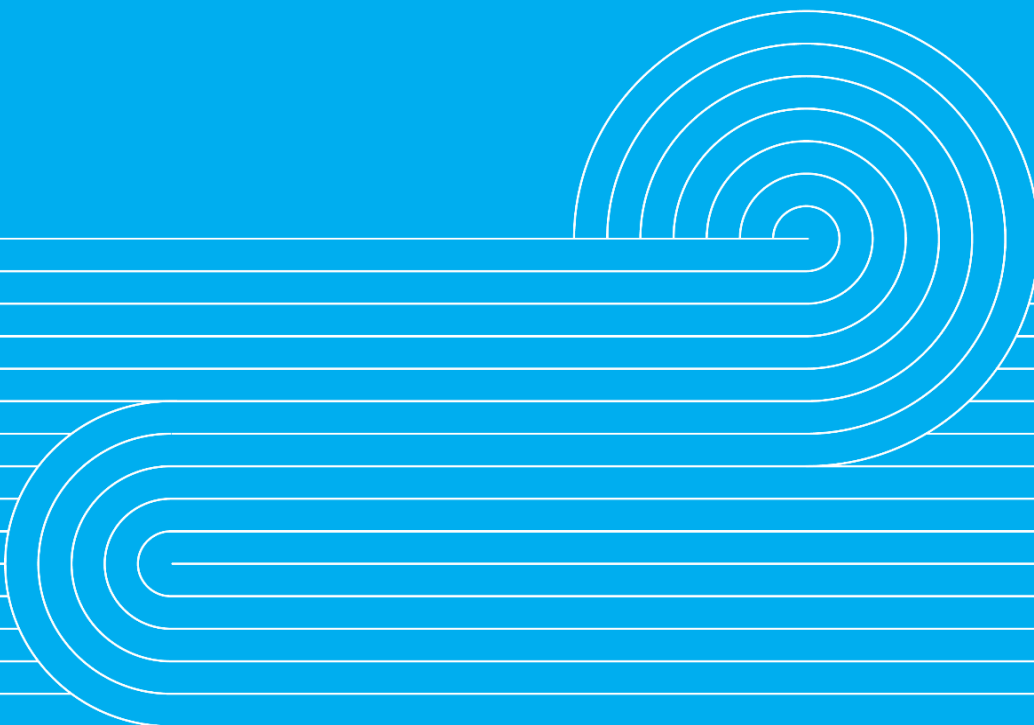
- workload is similarly high when integrating new technologies into the wholesale electricity market due to Code interpretation, tool and process changes or workarounds.
- interpretation of the Code and how it is applied for new technologies is critical. As new technologies can be brought to market much faster than traditional technologies, timing is a key part of this clarification.
- a close working relationship with Authority policy teams is critical in working through the implementation of new market design for the first time.
- consideration needs to be given to not only system operator tools and processes but other parts of the end-to-end process such as NZX tools and processes, along with those of the new participant.

Further opportunity

There would be value in reviewing and optimising the connections process, which includes the system operator commissioning process.

The very high level of interest from renewable generators in connecting to the grid highlights a need to further progress work on grid forming and grid following inverter technologies to ensure a secure, reliable, and efficient system.

5 Delivery: other activities



5.1 Risk assessment

The risk bowtie is our primary risk management tool used to manage the system operator key threat of “not having power system assets available to manage the system”.

We presented a deep dive risk paper on how we use the bowtie to the Authority system operations committee (SOC) meeting on 17 April, specifically providing a winter 2023 lens to the process. The paper outlined the likelihood of the threats, controls in place to manage the threats and the effectiveness of those controls.

Each year we perform two rounds of self-assessment to assess our critical controls.

- In November, the five critical risk controls assessment were: 24 hour real-time (partially effective), business support functions (fully effective), incident preparedness and response (fully effective), power system planning (partially effective), and support of critical tools and systems (fully effective).
- In May, the five critical risk controls assessment were: monitoring & evaluating future operating environment (partially effective), stakeholder management (partially effective), connected asset and system monitoring (fully effective), people management (fully effective), and change management (fully effective).



Continue to automate current manual processes that may introduce human error into the process.

Succession planning and other initiatives to build organisational resilience are important to have in place for key roles and single points of failure.

Further opportunity

To increase our effectiveness in the partially effective controls we can make a number of improvements: replace manual power system processes as part of our customer portal project, roll out the operational excellence programme to lift our performance in 24 hr real-time activities, develop proposed Code changes as appropriate, improve our people succession planning for the future operating environment, socialise our education and engagement planning, as well as continuing to increase our participation in industry working groups.

5.2 Business continuity plan testing

Business continuity plan (BCP) testing is a method of looking into how prepared the organisation and our people are in an emergency. It is a simulation in which our employees and other parts of the industry can practice how they must work together to find a solution to resolve a realtime event. In essence, it is a drill for what happens if a major problem arises.

This year we had a live use of our BCP following the weather events of Cyclone Gabrielle in Hawke’s Bay and Tairāwhiti in February 2023. Flooding during Cyclone Gabrielle caused extensive damage at the Redclyffe substation in Hawke’s Bay, resulting in the loss of electricity supply to Hawke’s Bay and Tairāwhiti. We worked efficiently and effectively with the grid owner and local EDBs to restore energy to the region using our coordinated incident management system (CIMS) roles to our internal roles and provide context to support our response.



Ensure we do not close down our incident management response team earlier than necessary. In the case of Hawke's Bay, recovery is still occurring, and an incident management team is a good way of ensuring coordination across the business.

'Resiliency' of backup communications is an important part of the process, e.g. satellite phones functionality.

Further opportunity

Investigate implementing a process update for confirmation of the receipt of grid emergency notices (GENs) where communication channels with impacted participants are suspected to be impaired.

Develop an operational policy on the level of redundancy needed for maintaining appropriate operational control room communication.

5.3 Industry engagement

We engage with industry on a regular basis to ensure transparency of our role, and to provide insight and information to inform stakeholder decisions. We also gather advice and feedback to inform our own decisions and improvements to our service.

89% of the respondents to our annual participant report agreed or strongly agreed that, overall, Transpower performs well in providing the system operator service. Responses to the participant survey provided very positive feedback to our continued fortnightly system operator industry forums.

The fortnightly system operator industry forums provide a useful platform to discuss the detail and our learnings from the system events that happened this year (refer to section 4.2 of this report). We also engaged with industry in a number of ways to discuss or inform potential industry-wide evolving situations (such as severe Auckland and Hawke's Bay flooding, HVDC outages, and low hydro in Southland.)

We have been working closely with electricity distribution companies this year, in particular with the Flex

Forum which is exploring how to best design and procure flexibility services from market participants and consumers. As part of this forum, we discussed with National Grid ESO (the UK system operator) and Octopus Energy, the innovative UK Demand Flexibility Service which was tested recently. In June, we were elected to the steering committee of Flex Forum as it prepares for its next phase of work.

We published a whitepaper on distribution-connected flexibility in December and received six, generally supportive, submissions. We have a system operator representative on the Electricity Networks Aotearoa (ENA) Smart Tech Working Group workstream "Collaborative solutions" to cover issues directly relevant to the topics covered in our whitepaper.

"Transpower as the SO strives to meet the market needs in an ever increasing challenging environment, I believe they are constantly looking at methods to improve their service and meet the needs of the industry"

Market Participant

We continue to evolve our IST systems and processes as new technologies, business models, and participants enter the market. We recognise the value in working collaboratively with stakeholders to identify how our service and the market more broadly may need to evolve to support them to engage on a level playing field. Our customer portal programme has successfully been extended to include the Planned Outage Coordination Process (POCP) application, the new NZGB application and the communication for the dispensations and equivalences process. We accompanied the deployment of these pieces of work with training material, including instruction videos and webinars.

"Fortnightly industry briefings is a huge improvement. Simulation exercise is also a big step in the right direction "

Market Participant

Our website provides a range of operational notices and reports, policies and other information that support our role. **Figure 2: Delivery against the 2022-23 Education and Engagement Plan** in Appendix 1 shows how the industry engages with these various forms of information.

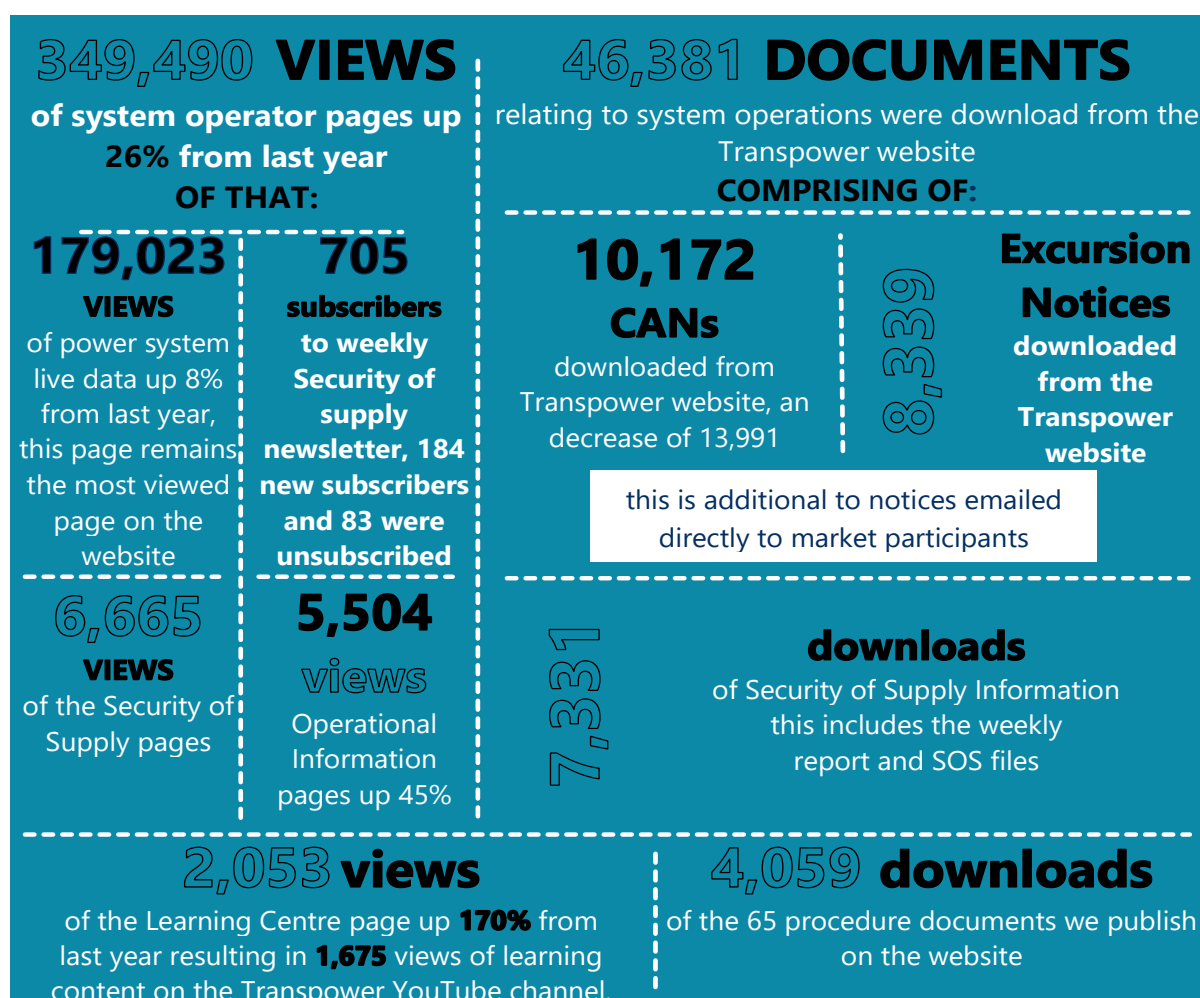


Figure 1: 2022-23 Industry engagement - website activity



Working with industry groups has provided a better understanding of the range of knowledge new and existing industry participants need to contribute to the secure operation of the grid.

We updated our operational notices in light of participant feedback to provide more clarity.

The Learning Centre page and YouTube channel are valuable resources for our customers.

Further opportunity

We expect to continue our work with EDBs and industrial users to understand how we can gain more visibility of the embedded generation and demand that will contribute to net offtake from the grid.

We have a representative on the ENA system operator-distributed system operations (SO/DSO) workstream in their 2023 workplan to explore how to improve the interface between us and the EDBs in a world of increasing DER penetration.

We believe there are still opportunities to improve our communication and have a project looking at improving how we send operational notices.

5.4 International engagement

System operators around the world exist in regulatory and market arrangements unique to their respective jurisdictions. However we are all experiencing a rapid change in the environment we work in, with changes to technologies reflecting different ways for participants and consumers to interact with the market. We continue to leverage our international relationships to understand how others are dealing with the new challenges facing the industry.

Examples of industry-wide engagement include:

- Attendance at Energy Systems Integration Group (ESIG) webinars ("Redefining resource adequacy for modern power systems", "Major disturbance on the ERCOT system" and "Ireland's transition to 75% inverter connected generation").
- Attending the Association of Power Exchanges (APEx) conference attended by other system operators from around the world.
- Attending the CIGRE working group C2 meeting.
- Attending the GE digital user conference in Australia which focussed on operational technology developments.
- Presenting online at the Florence School of Regulation workshop "From energy saving to rationing: getting it right".

This international engagement provided insight into our future thinking paper "Preparing for an increase in inverter-based resources", published in June.

We also meet our peers on a one-to-one basis, which have included with AEMO and UK industry energy players. For example, we spoke to National Grid Electricity System Operator about their operational transparency forum, to learn how we can improve our own fortnightly forum, and to inform how we might measure engagement as part of our refreshed performance metrics.



The lessons we have learned to improve our industry forum have received good feedback from the industry at the forums and as part of our annual survey.

Our experience is valuable to others. Our position as a highly renewable energy supplier has elicited much interest and this sharing of our experience provides a good platform to deepen our international engagement.

Further opportunity

Develop a more active engagement in international industry forums, such as ESIG by getting involved in working groups.

5.5 Cost of services reporting

The cost of services reporting, for 2021-22 was delivered to the Authority on 3 May 2023.

5.6 Compliance

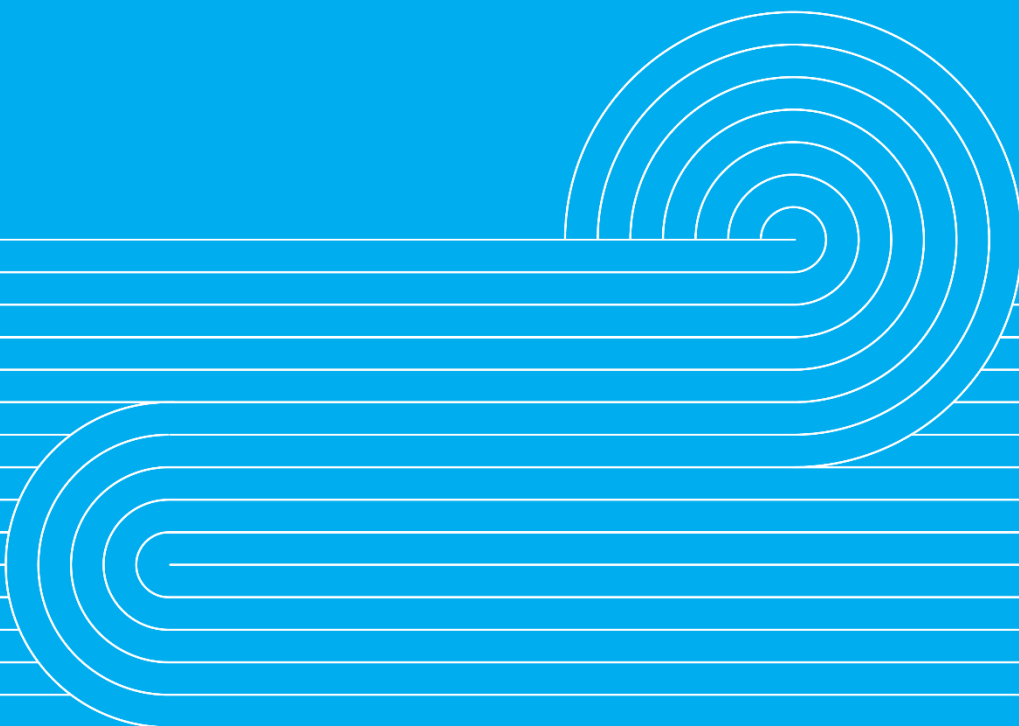
This section covers compliance with both the Code and Policy Statement.

We reported four system operator self-breaches this year. We have previously engaged with the Authority about the complexity involved in modelling the grid ahead of and in real-time. This complexity has recently increased as the system operator has implemented more sophisticated modelling changes to improve grid efficiency and capacity. The deployment of Real Time Pricing added to this complexity. We recognise the need to adapt to the recent increase in complexity; under our continuous improvement programmes we are refining and adapting our systems and processes to better manage the complexity. We have been developing a presentation to guide the Authority through our system modelling process and how it has recently evolved. We hope this will develop a shared understanding of the complexity involved and build a platform for future discussions when modelling issues arise. We will share this with the Authority this calendar year.

In early May 2023, the Rulings Panel issued its decision in respect of the 9 August 2021 grid emergency. The Rulings Panel decision was based on the joint statement of facts and penalty submission filed by the Authority and system operator.

Following the implementation of Real Time Pricing and the Authority's winter 2023 option around discretionary demand management, the system operator and Authority have collaborated, and will continue to collaborate, on Code interpretation and any amendments necessary to ensure alignment with operational practices.

6 Appendices



APPENDIX 1: DELIVERY AGAINST THE EDUCATION AND ENGAGEMENT PLAN FOR 2022-23

Forums/workshops	
<i>To present on several areas of system operator work that will affect and/or are of interest to the industry. Areas of work will vary depending on what is topical at the time.</i>	
2 forums to focus on system operations (one in each half of year)	
1 st half	<ul style="list-style-type: none"> Supported Authority at the RTP industry go-live forum (November)
2 nd half	<ul style="list-style-type: none"> Black Start simulation for the lower South Island (February) Outage Planning forum (March) Industry simulation exercise on insufficient offered supply to meet winter peak demand (May)
Relationship management – General industry participants	
<i>To address specific issues with affected industry participants. Meetings will be attended by relevant system operator employees, based on the issues being discussed.</i>	
6 meetings (one in each quarter of the year, plus two additional meetings)	
1 st quarter	<ul style="list-style-type: none"> Two online industry briefings on forecast generation capacity shortfall (August) Collective Network Operations Group (CNOG) meeting (Sep)
2 nd quarter	<ul style="list-style-type: none"> Industry briefing on tight residuals on October 7 (October) HVDC filter trip on October 7 @ Industry forum (October) Hawke's Bay double lightning strike @ Industry forum (November)
3 rd quarter	<ul style="list-style-type: none"> NINO distributors' meeting (Mar) Low hydro in Southland (Jan) –part of an SO industry forum Two HVDC outages required for annual maintenance (Feb, Mar) –part of an SO industry forum
4 th quarter	<ul style="list-style-type: none"> Future winter peaking issues @ Industry forum (April) Navigating the winter capacity challenge @ Industry forum (May) Collective Network Operations Group (CNOG) meeting (Jun)
Relationship management – Smaller industry participants	
<i>To address specific issues with affected industry participants. These meetings will be focused on the needs of smaller industry participants and will be attended by relevant system operator employees, based on the issues being discussed.</i>	
2 meetings (one in each half of the year)	
1 st half	<ul style="list-style-type: none"> SolarZero to determine how they could offer 6-second and 60-second reserve into the market (started in October 2022) Supported and informed Flex Forum industry working group which is exploring how to best design and procure flexibility services from market participants and consumers (August) Working with a distribution company throughout October to understand growth in peak demand at a more granular, regional level (October – November) Presented to ENA Smart tech Working Group on Distributed Flexibility (Dec)
2 nd half	<ul style="list-style-type: none"> Flex Forum workshop (February) Follow-up sessions with two EDBs to continue the discussions arising from our distribution-connected flexibility paper (June)
Training	
<i>To increase understanding of the key technical tools and concepts that materially impact market outcomes.</i>	
2 training courses (one in each half of the year)	
1 st half	<ul style="list-style-type: none"> Training videos and online workshops on use of POCP in the customer portal (July) Training videos and online workshops on use of NZGB in the customer portal (November)
2 nd half	<ul style="list-style-type: none"> 1-on-1 engagement with participants on the dispatchable demand tools and concepts

Figure 2: Delivery against the 2022-23 Education and Engagement Plan

APPENDIX 2: LESSONS LEARNED

This appendix captures all lessons learned noted through this report, grouped in themes for easier reference.

Collaboration

Performance metrics (p9): Working collaboratively means both parties are engaged in the performance framework and invested in the need to continually maintain and the monitor it into the future.

Performance metrics (p9): The collaborative approach has built positive relationships and good practice which could be deployed across other regulatory and organisational change involving both organisations.

Strategic plan (p11): We have received positive feedback on both the quality of content of the strategic plan and the collaborative and engaging process used for its development. Testing both the methodology and the content with Authority staff and other stakeholders delivered both a better output and outcome.

Long-term security of supply (p12): "Joining the dots" between deliverables and organisations - in this case, market insight papers, the new SOSA sensitivity, and the Authority's winter consultation - enables coordinated cross-industry response to system challenges.

System events (p17): Working closely with the industry to minimise the effects of system events has provided good two-way learning. The Authority considered the exercise to be "successful, professional, and collaborative".

Industry engagement (p28): Working with industry groups has provided a better understanding of the range of knowledge new and existing industry participants need to contribute to the secure operation of the grid.

International comparisons

Load modelling (p10): From our investigation into load modelling techniques and comparing what we do today versus what other system operators are doing, we have learned that although we are managing the change well, other countries are looking at how to do it better and we need to keep pace.

International engagement (p29): Our experience is valuable to others. Our position as a highly renewable energy supplier has elicited much interest and this sharing of our experience provides a good platform to deepen our international engagement.

Communication

Better information (p15): Residuals have proved a good way of communicating security margins to the industry.

Potential event communication (p17): Early notification to the industry on potential events has been highlighted as valuable by participants in their survey responses as these enable them to react ahead of time.

BCP testing (p26): 'Resiliency' of backup communications is an important part of the process, eg satellite phones functionality.

Industry engagement (p28): We updated our operational notices in light of participant feedback to provide more clarity.

Industry engagement (p28): The Learning Centre page and YouTube channel are valuable resources for our customers.

International engagement (p29): The lessons we have learned to improve our industry forum have received good feedback from the industry at the forums and as part of our annual survey.

Event communication (p17): Cyclone Gabrielle had significant impacts on the grid and managing the system securely through these challenges; this also had an impact on the market. One participant, as part of our annual survey, suggested we prioritised real time system security over market efficiency in one or more instances during this period. This is a reminder of the importance of how we communicate our decisions, PPOs, and overall role to stakeholders.

Use of pilots

Security of supply (p15): The ability to trial small-scale pilots has enabled us to improve our knowledge in these areas of work and contribute to a fast turnaround of adoption when needed, such as the sensitivity schedules pilot and the wind forecast comparison.

Performance metrics (p19): In addition to putting an important focus on how the system operator prepares for and manages system events, the design of the new event metrics provided a valuable “pilot” to learn from as we collaborated with the Authority to refresh the whole suite of performance metrics for 2023-24. Iterative and small-scale change of this sort can deliver results quickly and improve quality over time, based on real world testing.

Demand response (p22): Learnings from the integration of new participants and new technologies such as solarZero’s pilot include:

- there is a huge increase in workload when onboarding new participants who do not have a depth of technical and regulatory experience in the wholesale market and systems, and this may increase as market participation increases in the future. Education and support for new participants is essential.
- workload is similarly high when integrating new technologies into the wholesale electricity market due to Code interpretation, tool and process changes or workarounds.
- interpretation of the Code and how it is applied for new technologies is critical. As new technologies can be brought to market much faster than traditional technologies, timing is a key part of this clarification.
- a close working relationship with Authority policy teams is critical in working through the implementation of new market design for the first time.
- consideration needs to be given to not only system operator tools and processes but other parts of the end-to-end process such as NZX tools and processes, along with those of the new participant.

Ways of working

Market development (p10): The initial project management approach for TAS 102, with the Authority driving the work and the system operator providing SME input as required did not work as successfully as other TAS projects. For future projects we will discuss how the project and programme management can be optimised

BCP testing (p26): Ensure we do not close down our incident management response team earlier than necessary. In the case of Hawke’s Bay, recovery is still occurring, and an incident management team is a good way of ensuring coordination across the business.

Value of external perspectives

System event improvements (p17): An independent review of the System Operator’s performance during the grid emergency on 23 June 2022 notes that the system operator’s new demand management processes (implemented following the 9 August 2021 event) were successfully followed to manage the generation shortfall with minimal disruption to consumers.

SOSPA mechanisms

Programme delivery (p18): The TAS workshop delivered for the Authority highlighted that the SOSPA contains a variety of mechanisms for the system operator to deliver different types of work for the Authority, but there is limited awareness and familiarity with these mechanisms among staff. This reinforced the value of training around the SOSPA as a tool to deliver market change.

People and training

Risk assessment (p25): Continue to automate current manual processes that may introduce human error into the process.

Risk assessment (p25): Succession planning and other initiatives to build organisational resilience are important to have in place for key roles and single points of failure.

